# Maryland State STEM Standards of Practice Instructional Guide Grades 1-2

**April 2012**

Maryland State Department of Education
Preparing World-Class Students

**Table of Contents**

**Maryland State Department of Education Office of STEM Initiative Staff**

Donna Clem
Coordinator of STEM Initiatives

Raquel Marshall
Middle School STEM Specialist

Nira C. Taru, Ph.D
Elementary School STEM Specialist

Tiara Booker-Dwyer
High School STEM Specialist

**Maryland State STEM Standards of Practice Framework Writers Grades K – 5**

Dr. Fannia L. Boayue
Assistant Professor
Department: Educational Professions
Frostbury State University

Kathleen Barnagallo
Gifted and Talented Specialist
Howard County Public Schools

Frank Cardo
Instructional Coordinator for Science/STEM
Cecil County Public Schools

Tara Ellis
Curriculum and Instruction Specialist
Washington County Public Schools

Ramona Groff
Instructional Coach
Cecil County Public Schools

Kevin Hill
5th Grade Science and Social Studies Teacher
Westside Intermediate School
Wicomico County Public Schools

Jhanna Levin
PK-5 STEM Resource Teacher
Prince George's County Public Schools

Lindsay McConnell
4th Grade STEM and Reading Teacher
Monocacy Elementary School
Frederick County Public Schools

Erin McMahon
5th Grade ELA and STEM Teacher
Monocacy Elementary School
Frederick County Public Schools

Kara Reed
Supervisor for K-12 Mathematics
Office Washington County Public Schools

Amy Reese
Elementary Science Resource Teacher
Howard County Public Schools-Central

Jennifer Stemple
Challenge Instructional Coach
Lead Challenge Instructional Coach
Calverton Elementary School
Chesapeake City Elementary School
Cecil County Public Schools

Cheryl Wallace
K – 5 Mathematics Specialist
Anne Arundel County Public Schools

Carrie Zimmerman
Staff Development Teacher/ STEM Liaison
Fox Chapel Elementary and Middle Schools
Montgomery County Public Schools

## Introduction

### STEM Education

STEM education is an approach to teaching and learning that integrates the content and skills of science, technology, engineering, and mathematics. STEM Standards of Practice guide STEM instruction by defining the combination of behaviors, integrated with STEM content, which are expected of a proficient STEM student. These behaviors include engagement in inquiry, logical reasoning, collaboration, and investigation. The goal of STEM education is to prepare students for post-secondary study and the 21st century workforce.

STEM education removes the artificial barriers that isolate content and allows for an integrated instructional approach. The curriculum should allow students to develop life skills and apply content knowledge within a real world context. STEM education is active and focuses on a student-centered learning environment. Students engage in questioning, problem solving, collaboration, and hands-on activities while they address real life issues. In STEM education, teachers function as classroom facilitators. They guide students through the problem-solving process and plan projects that lead to mastery of content and STEM proficiency. STEM proficient students are able to answer complex questions, investigate global issues, and develop solutions for challenges and real world problems while applying the rigor of science, technology, engineering, and mathematics content in a seamless fashion. STEM proficient students are logical thinkers, effective communicators and are technologically, scientifically, and mathematically literate.

### STEM Education Pipeline

*Elementary School*

The development of STEM proficient students begins in elementary schools. In the elementary grades, students apply the rigor of science, technology, engineering, and mathematics content and the STEM Standards of Practice while engaged in learning activities that investigate the natural world. Students explore technology and engineering solutions and appropriately apply the concepts of mathematics in order to understand and address real life issues and solve problems or challenges. As students progress through elementary school they will begin to independently integrate the STEM Standards of Practice. They will understand how to apply the roles and views of STEM career professionals and analyze real world STEM issues, problems, or challenges as they incorporate STEM content, skills, and practices and other disciplines such as social studies, performing arts, health, and creative movement.

*Middle School*

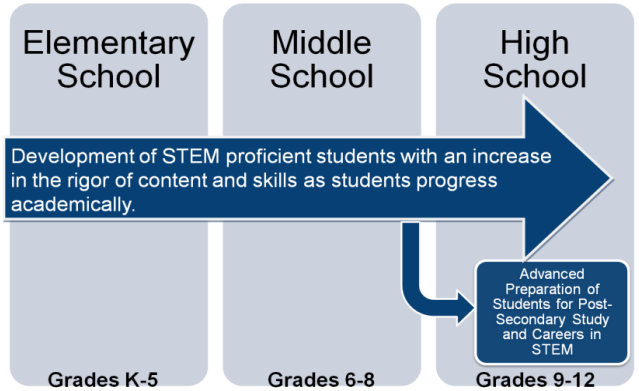
STEM education in middle school builds upon the foundational skills developed by students throughout elementary school. STEM essential skills and knowledge are further developed through guided instruction by the middle school teacher. Teachers facilitate learning activities that intentionally allow for middle school students to analyze and integrate content from science, technology, engineering, and mathematics to investigate global issues, answer complex questions, and develop solutions for challenges and real world problems. Middle school students will ask relevant questions, conduct research, refine questions based on research, and develop new questions that are relevant to understanding problems, global issues, or

challenges. Teachers will also facilitate learning activities that allow middle school students to refine critical thinking skills by applying scientific investigation and the engineering design process. By the end of eighth grade, students will be able to independently synthesize multi-disciplinary content to answer complex questions, investigate global issues, and develop solutions for challenges and real world problems.

*High School*

There are two goals for STEM education in high school. The first goal is on the development of STEM proficient students. All students will continue to grow in their STEM proficiency as they progress from grades 9:12. Students demonstrate independence and become more focused and sophisticated in their approach to answering complex questions, investigating global issues, and developing solutions for challenges and real world problems. STEM proficient students graduate with the basic skills and knowledge required to pursue post-secondary study or work in any field.

The second goal for STEM education in high school is on the advanced preparation of students for post-secondary study and careers in science, technology, engineering, or mathematics. High school provides a unique opportunity for students to explore different career paths and college majors through advanced coursework, career academies, magnet programs, STEM academies, specialized STEM programs, internships, and dual enrollment opportunities. Specific programs to address the needs for advanced preparation of students shall be determine by individual schools systems.



**Overview:**

In September 2008, Governor Martin O'Malley convened a P-20 STEM Task Force to discuss the state of STEM education in Maryland. As a result of the task force work, specific recommendations were made aimed at establishing Maryland as a global leader in the development of its workforce of the future, STEM-based research, and economic development infrastructure. The task force's recommendations were included in Maryland's application for a Race to the Top Grant. The grant describes twelve STEM-related projects, including developing STEM-based curriculum. The curriculum development process began in 2011 when Maryland State Department of Education staff specialists joined with stakeholders from across the state to define STEM education and develop STEM Standards of Practice. A total of 961 stakeholders reviewed and provided input on the STEM Standards of Practice via an on-line survey and face-to-face meetings. Stakeholders included representatives from all 24 Maryland local school systems, businesses and governmental agencies, colleges and universities, and other members of the community. In April 2012, the Maryland State Board of Education accepted the Maryland State STEM education definition and STEM Standards of Practice.

The development of the Maryland State STEM Standards of Practice Frameworks began in 2012 when the Office of STEM Initiatives convened multidisciplinary design teams. Design teams consisted of Maryland educators representing grades K-12 and higher education. The design teams identified what students should know and do to demonstrate proficiency with each STEM Standard of Practice by the end of grades K, 2, 5, 8, and 12. The Maryland State Department of Education staff and other stakeholders reviewed and refined the work of the design team. This document represents the culminating work of the design team and other stakeholders in identifying the essential skills and knowledge of STEM proficient students.

The purpose for the Maryland State STEM Standards of Practice Frameworks is to lay a foundation of STEM Education for all students. The Frameworks provide teachers and students a consistent approach to implementing STEM education and will provide guidance for teachers as they develop STEM centric units or lessons that focus on answering complex questions, investigating global issues, and developing solutions for challenges and real world problems.

**Implementation of the Maryland State STEM Standards of Practice Frameworks**

The Maryland State STEM Standards of Practice cross all grade levels and disciplines. Instruction in STEM education is a shared responsibility within a school. Therefore, all classroom teachers, supporting teaching staff, and special area teachers (e.g.: special education, gifted and talented, enrichment programs, afterschool programs, summer programs) can use the Maryland State STEM Standards of Practice Frameworks to engage students in STEM activities and tasks that develop STEM proficiency. Students should be given the opportunity to practice the essential skills and knowledge described while learning content. Implementation could occur through projects/themes that span multiple disciplines or through appropriate content-based infusion.

**Limitations of the Frameworks**

1. The Maryland State STEM Standards of Practice Framework sets the foundation for curriculum development by identifying process standards that are designed to be used with content standards.
2. The Maryland State STEM Standards of Practice are holistic in nature and have equal importance towards the development of STEM proficient students. The Framework is not intended to convey a hierarchical or sequential order for essential skills and knowledge, proficiencies, or standards.
3. The Maryland State STEM Standards of Practice Framework are written in grade bands to give school systems flexibility in the incorporation of STEM Standards of Practice in various content areas. Teachers should promote the development of the essential skills and knowledge over the course of grades K-5, 6-8, and 9-12.
4. The Maryland State STEM Standards of Practice Framework is a curriculum guide for educators. Teachers will need to plan accommodations, interventions, or enrichments required for special need students, English language learners, or gifted and talented students. Individual school systems can determine the appropriate modifications to meet the needs of their diverse populations.

**STEM Education in Elementary Schools**

In elementary STEM classrooms, students are actively engaged in questioning and hands-on activities while they investigate global issues, and solve real world problems, and/or challenges. Teachers facilitate student engagement, arouse student's questioning, guide students through the problem-solving process, and plan student projects that center on student's interest. As early as kindergarten, their learn to: ask and answer questions about real-life topics that affect their lives and the lives of others around them, solve problems, and explore STEM-related careers by learning and role-playing what scientists, technologists, technicians, engineers and mathematicians do in their career field. Grade: Kindergarten, students should have been introduced to STEM Standards of Practice that will engage them in scientific process, Maryland Technology Literacy Standards for Students, engineering design processes, and mathematics content and practices.

As students mature in age, first and second grade students begin to apply, with some assistance from the teacher, science, technology, engineering, and mathematics content while engaging in activities that focus on real-world questions, issues, problems or challenges. Students begin to independently explore real-world problems, apply the process of problem solving, scientific process, engineering design process, and Standards for mathematical Practices, integrate STEM Standards of Practice, form STEM teams, and work cooperatively and collaboratively in groups.

Grades: First through Second, students will have a clear understanding of STEM content, skills, and practices, and they would have been exposed to inquiry-based, problem-based, and project-:based learning. Beginning in the third grade, students focus on demonstrating an understanding of how to connect science, technology, engineering and mathematics content, practices or processes while engaging in inquiry-based, problem-based, and project-based learning activities. By the end of third grade, students will be able to integrate STEM content, practices and processes to other disciplines when asking questions, solving problems, or meeting challenges. Students should also begin to apply the STEM Standards of Practice

that will engage them in scientific process, Maryland Technology Literacy Standards for Students, engineering design processes, and mathematics content and practices.

By the end of fourth grade, students will be able to: design projects that are innovative and creative, analyze complex issues, solve complex problems and/or challenges, and independently apply STEM Standards of Practice into STEM activities. Students role play STEM professionals while engaged in STEM teams, incorporate engineering design process, science practices and Standards for Mathematical Practices into STEM activities, and logical reasoning when addressing or solving STEM related issues, problems, and/or challenges.

Grades: Third through Fifth, students will be able to independently demonstrate grade appropriate proficiency in all four STEM content areas, research various types of STEM subject matter experts in STEM fields, perform a STEM subject matter expert role when engaged in STEM teams, integrate other disciplines when engaging in a STEM lesson and/or project, and evaluate whether they have appropriately applied the STEM Standards of Practice while engaged in STEM activities. Student should also be able to independently demonstrate the science practices and Standards for Mathematical Practices, all K - 5 Maryland Technology Literacy Standards for Students, engineering design process, and inquiry-base, problem-base and project-base learning processes.

**Elementary STEM Standards of Practice and Framework**

The purpose for having Elementary STEM Standards of Practice and Framework is to lay a foundation of STEM Education for all students. STEM education is embedded in all content areas, specifically science, technology, engineering and mathematics. This document was designed by teachers and STEM coordinators from various grade levels, special education, English language learner, and English for speakers of other languages, and gifted and talented programs.

**How to Read this Document**

The curriculum writers approached the STEM Standards of Practice holistically: meaning, equal emphasis is given to each STEM Standards of Practice making each STEM Standards of Practice very important. The writers also applied a Transdisciplinary approach to STEM education where students answer complex questions, investigate global issues, and develop solutions to real world problems or challenges.

**Overall Document Organization**

The STEM Standards of Practice and Framework are comprised of seven practices. Each practice title is listed with a STEM proficient student statement explaining what a STEM proficient student will demonstrate. Each STEM Standard of Practice may list two or more student proficiencies, which are uppercase, letter A, B… A STEM proficiency statement is the behavior students are to demonstrate while engaged in STEM task over a course or year. The section identifying K, 2 and 5 represents Grade: Kindergarten, Grades: First through Second, and Grades: Third through Fifth. The essential skills and knowledge section includes a precursor statement explaining the expectation and support students will need to become a STEM proficient student. This section also contains skills and knowledge students will learn. Note: These bullets are not inclusive of all skills and knowledge students may demonstrate while engaging in STEM activities or tasks. Appendix A includes glossary words, and Appendix B is a list of references and online recourses.

**Who is responsible for STEM Standards of Practice and Framework?**

STEM is for all students. Therefore, all elementary classroom teachers, support teaching staff, special area teachers: art, music, library, physical education, inclusive or special education, gifted and talented, English language learners, and English for speakers of other languages, enrichment programs, afterschool programs and summer programs can use these STEM Standards of Practice and Framework to engage student in STEM activities and tasks. School administrators can also apply STEM Standards of Practice and Framework into the daily instruction in ELA, mathematics, social studies, science, and other discipline academic time blocks.

**Formatting Notes: Black Print** – Essential skills and knowledge identified by Maryland educators. These statements are intended to help teachers develop common understanding and valuable insights into what a student must know and be able to do to demonstrate proficiency with each STEM Standard of Practice; **Blue Print** : Glossary terms**;** and ***Purple Print*** – Essential skills and knowledge from other Maryland State Curriculum Standards.

**Maryland State STEM Standards of Practice**

1. **Learn and Apply Rigorous Science, Technology, Engineering, and Mathematics Content**

   *STEM proficient students will learn and apply rigorous content within science, technology, engineering, and mathematics disciplines to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.*

   A. Demonstrate an understanding of science, technology, engineering, and mathematics content.
   B. Apply science, technology, engineering, or mathematics content to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.

2. **Integrate Science, Technology, Engineering and Mathematics Content**

   *STEM proficient students will integrate content from science, technology, engineering, and mathematics disciplines as appropriate to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.*

   A. Analyze interdisciplinary connections that exist within science, technology, engineering, and mathematics disciplines and other disciplines.
   B. Apply integrated science, technology, engineering, mathematics content, and other content as appropriate to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.

3. **Interpret and Communicate Information from Science, Technology, Engineering, and Mathematics**

   *STEM proficient students will interpret and communicate information from science, technology, engineering, and mathematics to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.*

   A. Identify, analyze, and synthesize appropriate science, technology, engineering, and mathematics information (text, visual, audio, etc.).
   B. Apply appropriate domain-specific vocabulary when communicating science, technology, engineering, and mathematics content.
   C. Engage in critical reading and writing of technical information.
   D. Evaluate and integrate multiple sources of information (e.g.: quantitative data, video and multimedia) presented in diverse formats.
   E. Develop an evidence-based opinion or argument.
   F. Communicate effectively and precisely with others.

4. **Engage in Inquiry**

   *STEM proficient students will engage in inquiry to investigate global issues, challenges, and real world problems.*

   A. Ask questions to identify and define global issues, challenges, and real world problems.
   B. Conduct research to refine questions and develop new questions.

**5. Engage in Logical Reasoning**

*STEM proficient students will engage in logical reasoning to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.*

A. Engage in critical thinking.
B. Evaluate, select, and apply appropriate systematic approaches (scientific and engineering practices, engineering design process, and/or Standards for mathematical Practices).
C. Apply science, technology, engineering, and mathematics content to construct creative and innovative ideas.
D. Analyze the impact of global issues and real world problems at the local, state, national, and international levels.

**6. Collaborate as a STEM team**

*STEM proficient students will collaborate as a STEM team to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.*

A. Identify, analyze, and perform a STEM specific subject matter expert role.
B. Share ideas and work effectively with a STEM focused multidisciplinary team to achieve a common goal.
C. Listen and be receptive to ideas of others.
D. Analyze career opportunities that exist in a variety of STEM fields relevant to the STEM focused multidisciplinary team's goal.

**7. Apply Technology Strategically**

*STEM proficient students will apply technology appropriately to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.*

A. Identify and understand technologies needed to develop solutions to problems or construct answers to complex questions.
B. Analyze the limits, risks, and impacts of technology.
C. Engage in responsible/ethical use of technology.
D. Improve or create new technologies that extend human capability.

STEM Standard of Practice 1: **Learn and Apply Rigorous Science, Technology, Engineering, and Mathematics Content**

*STEM proficient students will learn and apply rigorous content within science, technology, engineering, and mathematics disciplines to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

A. Demonstrate an understanding of Science, Technology, Engineering, and Mathematics contents.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students should be able to:<br><br>• Recall and apply concepts presented in grade level *science*, *technology*, *engineering*, and *mathematics* content.<br>• Make connections between content and real life.<br>• Apply *Maryland Technology Literacy Standards for Students, science practices,* or *Standards for Mathematics Practices* to use when solving problems.<br>• Use the engineering design process when engaged in STEM activities to solve real world problems. | **Teacher Note:**<br>○ When teaching subject content in isolation (e.g. science concepts in science class), students are able to demonstrate their content knowledge through exit cards, hands on experiences, applying teacher instruction in a self-reflective manner, or responding in writing to share concept understandings. These individual skill understandings in content areas are used to build upon the connections they will make across content areas. Pre/Post formative (assessments for learning) and summative (assessments of learning) may also be used to determine students' mastery of content understanding.<br>○ In planning for science and math instruction consider ways in which to incorporate the engineering design process and other technologies related to the Maryland Technology Literacy Standards to engage in STEM practices. For example, during mathematics have students use technology (such as excel, power point, Prezi, graph club) to display and share findings with peers.<br>**Suggested Activities**<br>○ Students may participate in project based | **Professional Development Resources**<br><br>**The Works**<br>www.theworks.org click on "Teachers—Engineering Design Process"<br><br>**Maryland State Curriculum**<br>www.mdk12.org/instruction/curriculum/mathematics/index.htm click on content area of choice | **Engineering Design Process** - the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic science and mathematics and engineering sciences are applied to convert resources optimally to meet a stated objective.<br><br>**Project-based learning**—<br>Is a systematic teaching method that engages students in learning important knowledge and 21st century skills |

| | | | |
|---|---|---|---|
| | learning opportunities that utilize the engineering design process to demonstrate scientific and mathematical knowledge. For example, students may use number sense knowledge to consider and design a playground that meets the capacity needs of their grade level for recess while maintaining the available playground space for recess.<br>○ When teaching concepts within a discipline, discuss how the concepts relate to other disciplines (e.g. both science content knowledge and writer's craft are needed to write a book about volcanoes; to understand why people settle in a specific geographic area, students need social studies and science content knowledge). | | through an extended, student-influenced inquiry process structured around complex, authentic questions and carefully designed products and learning tasks.<br>**Discipline** –<br>A formal branch of knowledge or teaching (e.g., biology, geography, and engineering) that is systematically investigated, documented, and taught. |

STEM Standard of Practice 1: **Learn and Apply Rigorous Science, Technology, Engineering, and Mathematics Content**

*STEM proficient students will learn and apply rigorous content within science, technology, engineering, and mathematics disciplines to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

B. Apply science, technology, engineering, and mathematics content to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>With guidance and support from adults, students will::<br><br>• Determine how *science, technology*, *engineering,* or *mathematics* content can be used to better human life.<br>• Apply *science, technology*, *engineering*, or *mathematics* content, practice, or process when identifying and defining global issues.<br>• Choose the appropriate *science* and *mathematics* content to ask and answer complex questions or solve real world problems.<br>• Apply problem-solving skills to *science* and *mathematics* content. | **Teacher Note:**<br>○ Have students apply what they know about questions from content backgrounds to develop divergent questions for a current science unit of study (e.g. "I know a question is when you are asking something."; "Questions have answers, but there may be more then one correct answer or there may be more then one way to get to the correct answer." "Why does a caterpillar make a cocoon?").<br>○ Identify a local issue, such as recycling trash at lunch, which could be seen as science concept. Have students list possible solutions, which would make the recycling process at school more user friendly for all.<br>○ Students may select an issue that is larger than the community (global) that has been previously brainstormed or from a teacher generated list to consider individually, in pairs or in small groups. Students present reasonable solution to classmates (e.g. for the topic saving animal habitats students might identify creating national parks; not | **Professional Development Resources**<br>**Creative Problem Solving Process**<br>http://www.creativeeducationfoundation.org/our-process/what-is-cps click on "What is creative problem solving?"<br>**Primary Talent Development Modules from MSDE**<br>http://www.ccps.org/teachers/jstemple/Jennifer_Stemple/Introduction.html click on "process"<br>**Maryland State Curriculum**<br>www.mdk12.org/instruction/curriculum/mathematics/index.html click on | **Creative Problem Solving Process –**<br>Process to identify problems, generate ideas, and create an action plan to solve the problem.<br>**Divergent Questions** – open ended questions that have more then one correct answer, or more than one correct way to solve them.<br>**Solution** - the successful action of solving a problem, the answer that fixes |

| | | | |
|---|---|---|---|
| | building new housing developments).<br>○ Have students use the Creative Problem Solving Process and/or Engineering Design Process as a method to identify and investigate complex questions, global issues and real world problems. (e.g. redesign window coverings to reduce the amount of heat entering the classroom while allowing sunlight to enter).<br>○ Have students use the research process to look for current solutions and then use informational, persuasive or opinion writing to share what they learned and call for change. | **The Works** www.theworks.org click on "Teachers—Engineering Design Process"<br>**Environmental Topics for kids** www.nrdc.org/reference/kids.asp click on "For Kids"<br>**Research Process** https://docs.google.com/viewer?a=v&q=cache:Xap1Cm-ntGkJ:www.kyvl.org/docs/IntroductionToKYVLForKids.pdf+&hl=en&gl=us&pid=bl&srcid=ADGEEShVQ_Ge329sVfgJwESoj5GQ5OfHSzk_hxHOFN661mBhYBn9zsgPN5SbwT1P4vTRSUbj44UCiMpBt_xAOwwn15AJJwktz529PCdZNTURFs8TurA2km3ohaeuzfmKTc9EnVSrXp1H&sig=AHIEtbSiH2ZoyqLglKtJqC8a_5p5g4taeg click "Quick View" | the problem.<br>**Issue** - an important question that is in dispute and must be settled.<br>**Reasonable questions** – logical or able to be done within the constraints given (time, money, natural, capitol & human resources available, etc.).<br>**Local** – in close proximity to a given location, community.<br>**Global Issues** –<br>Issues that impact the Earth as a whole, problems that concern a population throughout the world. A global issue is an issue that's going on all over the world meaning it not only going on in a |

| | | | |
|---|---|---|---|
| | | | certain place. For example: global warming is a global issue, not like the oil spill it hasn't affected the whole world.<br><br>**Real world problems** –<br><br>Problems that actually occur in everyday life |

STEM Standard of Practice 2: **Integrate Science, Technology, Engineering, and Mathematics Content**

*STEM proficient students will integrate content from science, technology, engineering, and mathematics disciplines as appropriate to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

A. Analyze interdisciplinary connections that exist within the science, technology, engineering, and mathematics disciplines and other disciplines.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students should be able to:<br><br>• Explain connections between *science, technology, engineering*, and *mathematics* disciplines and other disciplines.<br>• Illustrate the appropriate connections between *science*, *technology*, *engineering*, and *mathematics* content to answer complex questions, investigate global issues, or solve a real world problems or challenges.<br>• Identify and apply *science practices* or *Standards for Mathematical Practices* when answering complex questions, investigating global issues, and solving real world problems or challenges. | **Teacher Note:**<br>○ As you teach, help students to make connections between what they are learning in a specific content area to what they are learning in other content areas. For example, in math students may be learning to graph data. In science, students may generate data during an experiment and use their math knowledge to organize and graph said data.<br>○ As students work to solve a problem, ask them to share how their knowledge of other content areas helps them. For example, a problem about natural capital and human resources in social studies may relate to an informational reading about a local grocery store.<br>○ Help students understand that persevering through problem solving is a life skill and will help in many situations. (If you get an incorrect answer to a math problem be persistent, use a different method, tool or manipulative.)<br>○ Point out to students how many of the problems we face today are not solved by individuals working in isolation, but rather diverse teams of people with different backgrounds, beliefs, and areas of strength. | **Professional Development Resources**<br>**MSDE Teaching and Learning Mathematics** www.mdk12.org/instruction/curriculum/mathematics/index.html click on mathematics<br><br>**Science Framework** http:www.nap.edu/catalog.php?record_id=13165 click on "Download Free" | **Science –** knowledge about or study of the natural world based on facts learned through experiments and observations.<br>**Technology** – Human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities.<br>**Engineering** – the application of science and mathematics by which the properties of matter and the sources of energy in nature are made useful to people. |

| | | | |
|---|---|---|---|
| | | | **Mathematics** – the science of numbers and their operations, interrelations, combinations, generalizations, and abstractions and of space configurations and their structure, measurement, transformations, and generalizations. |

STEM Standard of Practice 2: **Integrate Science, Technology, Engineering, and Mathematics Content**

*STEM proficient students will integrate content from science, technology, engineering, and mathematics disciplines as appropriate to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

B. Apply integrated science, technology, engineering, and mathematics contents to develop solutions to problems or construct answers to complex questions.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students should be able to:<br>• Identify and apply the appropriate *science* information when investigating global issues or solving real world problems or challenges.<br>• Compare and contrast information from *science*, *technology*, *engineering*, and *mathematics* to answer complex questions. *(CCSS RI.2.9)*<br>• Demonstrate the ability to connect multiple contents when answering complex questions, investigating global issues, or solving real world problems or challenges and justify those connections. *(CCSS Add Math & RELA)* | **Teacher Notes:**<br>○ Facilitate project-based learning experiences around a local issue or problem; choose an issue or problem (long lunch lines in the cafeteria) that has relevance for the students and can be used to address specific standards within the curriculum being studied. Students generate questions or concerns about the issue or problem. Create teams of SMEs (representing Science, Technology, Engineering, Math, and other appropriate content areas) to study the issue or problem. Help students use interdisciplinary grade level knowledge to connect to the real life context.<br>○ Students will analyze questions to determine individual components that need to be addressed. Students will note what they already know about the topic and determine what information needs to be gathered to fully answer the question. Students will gather pertinent information to answer question components and reflect independently and/or collaboratively about information and questions. Students will use logical reasoning to look for relationships among the information. Students will connect information | **Student Resources**<br>**Primary Talent Development Modules from MSDE** http://www.ccps.org/teachers/jstemple/Jennifer_Stemple/Introduction.html click on "process"<br>**Professional Development Resources**<br>**Creative Problem Solving Process http://www.creativeeducationfoundation.org/our-process/what-is-cps** click on "What is creative problem solving?"<br>**Integrating Curriculum** | **Integrate**—combine knowledge from multiple disciplines.<br><br>**Facilitate**—to help bring about learning or make learning easier.<br><br>**Project-based learning**—an instructional approach that uses a real life context to answer complex questions, global issues, and/or real world problems.<br><br>**SME**—subject matter expert |

| | | | |
|---|---|---|---|
| | to identify solutions and/or alternatives for complex questions.<br>○ Model the Creative Problem Solving Process for students, use the I Do, We Do, You Do approach as a scaffold to enable students to complete the process to search to answer complex questions and/or solve global issues and to develop solutions for challenges and real world problems. Students identify information sources and evaluate them based on currency, authority and accuracy, and relevancy. Students use a graphic organizer or note-taking device and close read to gather information that addresses the complex question, global issue, or real world problem. Students identify possible solutions, use a decision matrix to evaluate those solutions and select the most appropriate choice based on the criteria determined in the decision matrix. Students develop an action plan and implement their solution. | **http://www.ascd.org/publications/books/103011/chapters/What-Is-Integrated-Curriculum%C2%A2.aspx** click on "Transdisciplinary Integration" | **Subject Matter Expert –** a person who as comprehensive and/or authoritative knowledge or skill in a particular area.<br><br>**Creative problem solving process** – process to identify problems, generate ideas , and create an action plan to solve the problem<br><br>**Close read** – observing facts and details about a text and interpreting those details.<br><br>**Decision matrix** – table used to evaluate possible outcomes to an action plan.<br><br>**Action plan** – a series of steps and/or activities that must be |

| | | | |
|---|---|---|---|
| | | | successfully completed to achieve a goal.<br><br>**I Do, We Do, You Do –** an instructional strategy where practice is scaffolded to support the learner's needs. The teacher models for students, students work in groups for guided practice and then finally students work independently. |

STEM Standard of Practice 3: **Interpret and Communicate Information from Science, Technology, Engineering, and Mathematics**

*STEM proficient students will interpret and communicate information from science, technology, engineering, and mathematics to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

A. Identify, analyze, and synthesize appropriate science, technology, engineering, and mathematics information (text, visual, audio, etc.).

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br>• Identify and compile information from appropriate sources (text, visual, audio, etc.) from *science*, *technology*, *engineering*, or *mathematics* to aide in answering complex questions, investigating global issues, solving real world problems or challenges. *(CCSS RI.2.7)*<br>• Compare and contrast information gathered from multiple sources when, investigating global issues, real world problems or challenges. *(CCSS RI.2.9)* | **Teacher Notes:**<br>○ Identify two information sources [text, visual, audio, digital, print, multimedia, SME (subject matter expert), etc.] that could be used to help answer the complex question, investigate the global issue, or develop the solution for the real world problem and evaluate them based on currency, authority and accuracy, and relevancy.<br>○ Use a graphic organizer or note-taking device (see resources column for links) and close read or other appropriate strategies to gather information from sources to determine main ideas and details<br>○ Analyze the information gathered by sorting/categorizing, comparing/contrasting, evaluate the appropriateness of information<br>○ Synthesize the information gathered to make a new or more in-depth understanding of the information. | **Professional Development Resources**<br>**Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts**<br>http://mdk12.org/instruction/curriculum/reading/index.html click on (CCSS 2 RL, 3)<br><br>**Graphic Organizer websites:**<br>http://www.eduplace.com/kids/hme/k_5/graphorg/ click on graphic organizer of choice<br><br>**Big 6 Information Skills**<br>http://nb.wsd.wednet.edu/big6/big6_resources.htm | **Close read** – observing facts and details about a text and interpreting those details.<br><br>**SME** - Subject Matter Expert.<br><br>**Subject Matter Expert** – a person who as comprehensive and/or authoritative knowledge or skill in a particular area.<br><br>**Graphic organizer** – different ways to visually organize information. |

| | | | |
|---|---|---|---|
| | ○ Discuss with students that there are different formats for communication based on the topic, audience and purpose (see resource column for link which contain rubrics for different types of communication with examples which could be used to explain differences in components of formats). Communicate in an appropriate format (writing, illustrations, orally, through print or digital media) to share understanding with others. | click on resources for each step<br><br>**Rubrics for communication**<br>http://<br>www.bcps.org/offices/lis/models/tips/productselem.html<br>explore site links | |

STEM Standard of Practice 3: **Interpret and Communicate Information from Science, Technology, Engineering, and Mathematics**

*STEM proficient students will interpret and communicate information from science, technology, engineering, and mathematics to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.*

B. Apply appropriate domain-specific vocabulary when responding and discussing science, technology, engineering, and mathematics contents.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br><br>• Access prior knowledge and experiences to determine and clarify meaning of words and phrases in a text. *(CCSS RI.2.4)*<br>• Comprehend symbols and words used in *science*, *technology*, *engineering* and *mathematics. (See MTLSS 1&2.4.B.1a)*<br>• Determine the meaning of words, phrases, and or symbols in text relevant to grade 2 topics or subject areas. *(CCSS RI. 2.4; SC, 2)*<br>• Use text features to clarify meaning of words and phrases and enhance comprehension of in informational text. *(CCSS RI.2.4)* | **Teacher Notes:**<br>○ Identify and define domain-specific vocabulary terms as students learn information in Science, Technology, Engineering, and Mathematics contents. Use content word walls that include domain-specific vocabulary words, their definitions, and examples (there are many different vocabulary strategies including Frayer Models, LINCs, see the links in the resources column for examples).<br>**Suggested Activities:**<br>○ Have students keep content dictionaries or vocabulary lists and/or other devices for domain-specific vocabulary words, their definitions, and examples (there are many different vocabulary strategies including Frayer Models, LINCs, see the links in the resources column for examples). | **Professional Development Resources**<br><br>**Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts**<br>http://mdk12.org/instruction/curriculum/reading/index.html click on CCSS 2 RL, 4<br><br>**Vocabulary Strategies**<br>http://www.justreadnow.com/strategies/vocabulary.htm click on hyperlinks to view different strategies.<br><br>**Frayer Model with Content Area Examples**<br>http://www.tantasqua.org/superintendent/Profdevelopment/etfrayermodel.html explore examples<br><br>LINC strategy<br>http://www.k8accesscenter.org/ | **Domain-specific vocabulary** – terms used within the context of the content area.<br><br>**Language of the discipline** – the language professionals in a given field use to communicate with their peers. |

| | | | |
|---|---|---|---|
| | ○ Students use the language of the discipline – the vocabulary terms appropriately in their communications (writing and speaking) about the content. | documents/JKnight.webinar.ppt download PPT and scroll through to LINC section. | |

STEM Standard of Practice 3: **Interpret and Communicate Information from Science, Technology, Engineering, and Mathematics**

*STEM proficient students will interpret and communicate information from science, technology, engineering, and mathematics to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

C. Engage in critical reading and writing of technical information.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br>• Engage in critical reading of informational texts by, *(CCSS RI.2.5)*<br>  • Pre-reading/engaging with text.<br>  • Reading words and symbols from informational text to examine meaning.<br>  • Rereading to identify central ideas and key supporting details.<br>  • Comprehending informational text.<br>  • Summarizing informational text. *(CCSS RI. 2.2; SC, 2;See MTLSS 1&2.4.A.1a-c;MS SLM 2-3.6.1a)*<br>• Engage in writing informational texts by,<br>  • Understanding the difference between narrative and technical writing.<br>  Writing informative/expository texts to answer complex questions, respond to global issues, or to solve real world problems or challenges. *(CCSS RI.2.5; W2;See MS SLM 2-3.6.A.1d)* | **Teacher Notes:**<br>○ Students read, "close read" age appropriate expository texts to gain information or perform a task related to *Science, Technology, Engineering and Mathematics*.<br>○ Identify and read text features of technical texts (e.g. bold words, symbols, glossary, foot notes, tables, graphic aides).<br>○ Reread as needed to support comprehension of technical information. Consider having students use appropriate note taking devices to identify central ideas and key details which aide in summarizing.<br>○ Review different formats for technical texts (e.g. recipe, report, directions to perform a task, observations from an experiment or problem solving method). Discuss that each format has an intended purpose and audience as well as specific components.<br>○ Students use informative and technical writing forms to provide information or directions to perform a task related to *Science, Technology, Engineering and Mathematics*. | **Professional Development Resources**<br>**Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts** http://mdk12.org/instruction/curriculum/reading/index.html click on CCSS 2 RL, 7, 10 | **Close read** – observing facts and details about a text and interpreting those details.<br>**Expository text –** the nature of exposition; serving to expound, set forth, or explain.<br>**Nonfiction/informational text** - Includes literary non-fiction, expository text, technical text, procedural text, and functional text.<br>**Technical texts** – formula reading relating to or characteristic of a particular field.<br>**Technical writing –** Treating a document with the goal of providing clear and concise information, rather than |

| | | | |
|---|---|---|---|
| | | | entertainment or story telling; a technical document/report incorporates diagrams and multi-media information to provide technical information.<br>**Real world problems** –<br>Problems that actually occur in everyday life<br>**Challenges**-<br>A problem or concern that should be addressed. A competition. |

STEM Standard of Practice 3: **Interpret and Communicate Information from Science, Technology, Engineering, and Mathematics**

*STEM proficient students will interpret and communicate information from science, technology, engineering, and mathematics to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

D. Evaluate and integrate multiple sources of information (e.g.: quantitative data, video and multimedia) presented in diverse formats.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br><br>• Identify and locate numerous information sources to answer complex questions, investigate global issues, and solve real world problems or challenges. *(CCSS RI.2.5)*<br>• Know and use various text features (e.g., captions, bold print, subheadings, glossaries, indexes, electronic menus, icons) to locate key facts or information in a text efficiently. *(CCSS RI.2.5)*<br>• Organize information from multiple texts or sources to answer complex questions, investigate global issues, or solve real world problems or challenges. *(See MTLSS 1 &2.4.C.1a)* | **Teacher Notes:**<br>○ Help students understand that different information sources have a specific format for communication based on the topic, audience and purpose (see resource column for link which contain rubrics for different types of communication with examples which could be used to explain differences in components of formats).<br>○ Identify information sources [text, visual, audio, digital, print, multimedia, SME (subject matter expert), quantitative data, video] and determine the type of information they provide<br>○ Evaluate information sources based on currency, authority and accuracy, and relevancy and their relationship to the complex question, global issues and challenges and real world problem being addressed<br>○ Gather and synthesize information from multiple sources to generate a new or more in depth understanding. Address any opposing information by determining why/how the information is conflicting (e. g. point of view may be from a company who wishes to develop land with an oil refinery or the EPA whose goal is to conserve the land). | **Professional Development Resources**<br><br>**Maryland Common Core State Standards– Reading / English Language Arts** http://mdk12.org/instruction/curriculum/reading/index.html click on CCSS 2 RL,10 | **SME -** Subject Matter Expert<br><br>**Subject Matter Expert –** a person who as comprehensive and/or authoritative knowledge or skill in a particular area. |

STEM Standard of Practice 3: **Interpret and Communicate Information from Science, Technology, Engineering, and Mathematics**

*STEM proficient students will interpret and communicate information from science, technology, engineering, and mathematics to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

E. Develop an evidence-based opinion or argument.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br><br>• Form an opinion based on prior knowledge and information provided. *(CCSS W.2.1a)*<br>• Differentiate between facts and opinion within a specific source. *(CCSS W. 2.1b)*<br>• Listen and respond appropriately to the opinion of individuals and/or groups.<br>• Draft a concluding statement that restates the opinion. *(CCSS W.2.1d)* | **Teacher Notes:**<br>○ Gather and synthesize information from multiple sources to generate a new or more in depth understanding.<br>○ Look at information from multiple points of view to consider multiple perspectives about a topic.<br>○ Form an opinion based on a main idea about the topic. Opinions are based on prior knowledge and information provided<br>○ Locate evidence by discriminating between facts and opinions.<br>○ Evidence can have many formats or sources (e.g.<br>Facts; Statistics; Quotations from authority figures;<br>Data; Primary and secondary source information) Identify evidence that supports their opinion.<br>○ Evaluate information sources based on currency, authority and accuracy, and relevancy and their relationship to the complex question, global issues and challenges and real world problems being addressed. | **Professional Development Resources**<br><br>**Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts** http://mdk12.org/instruction/curriculum/reading/index.html click on CCSS 2 W,1 | **Opinion**—a view or judgment formed about something.<br><br>**Evidence**—available facts or information that show whether a belief or idea is true or false.<br><br>**Global Issues** – issues that impact the Earth as a whole, problems that concern a population throughout the world.<br><br>**Real world problems** – problems that actually occur in everyday life.<br><br>**Challenges**-<br><br>A problem or concern that should be addressed. A competition. |

STEM Standard of Practice 3: **Interpret and Communicate Information from Science, Technology, Engineering, and Mathematics**

*STEM proficient students will interpret and communicate information from science, technology, engineering, and mathematics to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

F. Communicate effectively and precisely with others.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br><br>• Distinguish between relevant and irrelevant details. *(CCSS SL.2.4)*<br>• Use a variety of formats to prepare the finding/conclusions of an information need for sharing. *(CCSS SL.2.5)*<br>• Use technology to record and organize data/information. *(CCSS SL.2.5)*<br>• Ask and answer questions such as who, what, where, when, why, and how to facilitate understanding of key details *(CCSS SL.2.3; See CCSS RI. 2.2; MD MS SLM 2-3 3B1.a)*<br>• Use appropriate non-verbal techniques to enhance communication, e.g., posture, eye-contact, facial expressions, gestures. *(CCSS.SL.2.4)*<br>• Communicate understanding of information to others. *(See MTLSS 1&2.4.C.1a)* | **Teacher Notes:**<br>○ Review the concept of listening with students. Have students compare hearing with listening. Identify strategies to promote active listening skills. Discuss when and why listening might be important. (e.g. directions to a new place, safety/fire drill, civil defense drill, bus emergency drill, other procedures).<br>○ Introduce active speaking skills and provide students with guided practice. Skills include: following agreed-upon rules for discussions, gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion, build on others' talk in conversations by linking their comments to the remarks of others, ask for clarification and further explanation as needed about the topics and texts under discussion, recount or describe key ideas or details from a text read aloud or | **Professional Development Resources**<br>**Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts** http://mdk12.org/instruction/curriculum/reading/index.html<br>**click on** CCSS 2 RL, 4 **and** CCSS 2 SL, 1<br>**Touchstones Discussion Project** http://www.touchstones.org/ click on "About Us"<br>**Socratic Method** http://www.goodcharacter.com/Socratic_method.html read example on page | **Active listening** - Active listening is a way of listening that focuses entirely on what the other person is saying and confirms understanding of both the content of the message and the emotions and feelings underlying the message to ensure that understanding is accurate.<br>**Technology**<br>Human innovation in |

Comment [SJ1]: What does this mean?

| | | | |
|---|---|---|---|
| | information presented orally or through other media.<br>○ Have students use their communication skills to share their thinking about global issues and real world problems. Encourage students to use domain specific vocabulary in their discussions as well as clearly articulated examples that support their thinking. | **Active Listening Teacher Resources**<br>http://www.mindtools.com/CommSkll/ActiveListening.htm view page<br>http://www.taftcollege.edu/lrc/class/assignments/actlisten.html view page<br>http://www.littleonesreadingresource.com/teaching-children-listening-skills.html view page<br>http://www.hrea.org/erc/Library/primary/Opening_the_Door/workshop2.html view page | action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities. |

STEM Standard of Practice 4: **Engage in Inquiry**

*STEM proficient students will engage in inquiry to investigate global issues, challenges, and real world problems.*

A. Ask questions to identify and define global issues, challenges and real world problems.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br><br>• Ask multiple questions to identify and define:<br>a. global issues.<br>b. real world problems or challenges. *(MS SLM 2-3. 6.A.1d)*<br>• Pose/ask questions about the problem/situation *(SS.2.6.C.2.b)* using question words (e.g. who, what, where, how, when and why) *(CCSS RI.2.1)*<br>• Identify what did not make sense. *(CCSS RI.2.1)*<br>• Make predictions or ask questions. *(CCSS RI. 2.1)*<br>• Ask additional or clarifying questions when relevant and appropriate to further investigate global issues or to solve real world problems or challenges. | **Teacher Notes:**<br>○ Review types of questions and identify question words (e.g. who what, where, how, when and why)<br>○ Review the purpose of asking questions (to investigate issues, find information/ knowledge, gather evidence/support, and form an opinion, to help us solve a problem or make a decision.) Questions may be related to a specific content area or may be transdisciplinary, which would be appropriate for STEM.<br>○ Build knowledge of and compare concepts of global issues v. challenges v. problems using available current events resources (such as; Time For Kids, Scholastic News, National Geographic Kids, Weekly Reader,) facilitate students in building an understanding that some problems impact specific people in a geographic location while others have a greater impact, even a global one.<br>○ Help students understand that the questions they ask may help them define larger issues, problems or challenges (e.g. when learning about healthy eating | **Professional Development Resources**<br>**Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts**<br>http://mdk12.org/instruction/curriculum/reading/index.html<br>**click on** CCSS 2 RL, 1 | **Transdisciplinary** –. In the transdisciplinary approach to integration, teachers organize curriculum around student questions and concerns. Students develop life skills as they apply interdisciplinary and disciplinary skills in a real-life context. Two routes lead to transdisciplinary integration: project-based learning and negotiating the curriculum. (Drake & Burns, 2005)<br><br>**Runoff** - the portion of precipitation on land that ultimately reaches streams often with dissolved or suspended material. |

| | | | |
|---|---|---|---|
| | habits, the issue of equity of global food distribution can be identified as a problem)<br>○ Establishing a classroom atmosphere of open questioning and discovery is essential. | | **Global issues** – issues that impact the Earth as a whole, problems that concern a population throughout the world.<br><br>**Challenges** – a problem or concern that should be addressed.<br><br>**Problems** – an issue concerning one or more people. |

STEM Standard of Practice 4: **Engage in Inquiry**

*STEM proficient students will engage in inquiry to investigate global issues, challenges, and real world problems.*

B. Conduct research to refine questions and develop new questions.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br><br>• Identify and gather appropriate information from *science*, *technology*, *engineering*, and *mathematics* content to investigate global issues, real world problems, or challenges.<br>• Begin to apply note-taking strategies when searching information related to STEM. (*See MS SLM 2-3. A.2c;B.1b)*<br>• Critically review information to better understand complex questions, real world problems, or global issues. *(MS SLM 2-3.4.2.2f)*<br>• Ask complex questions related to:<br>a. *science*, *technology*, *engineering*, and *mathematics*.<br>b. investigating global issues, solving real world problems, or challenges. *(MS SLM 2-3. 6.A.1d)*<br>• Create new questions using information from *science*, *technology*, *engineering*, and *mathematics* content, to further investigate global issues, real world problems, or challenges. *(MS SLM 2-3.1.A.1b)* | **Teacher Notes:**<br>○ Identify information sources [text, visual, audio, digital, print, multimedia, SME (subject matter expert), etc.] that could be used to help answer the complex question, investigate the global issue, or develop the solution for the real world problem and evaluate them based on currency, authority and accuracy, and relevancy.<br>○ Use a graphic organizer or note-taking device (see resources column for links) and close read or other appropriate strategies to gather information from sources to determine main ideas and details.<br>○ Analyze the information gathered by; sorting/categorizing, comparing/contrasting, evaluate the appropriateness of information. Examine key details. Evaluate initial question(s) and continue, refine or develop new questions based on the information gathered.<br>○ Synthesize the information gathered to make a new or more in-depth understanding of the information and refine or develop additional questions as needed. | **Professional Development Resources**<br>**Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts**<br>http://mdk12.org/instruction/curriculum/reading/index.html click on CCSS 2 RL, 3<br>**Organizers for gathering details and questions**<br>http://media.ccps.org/workbooks.html<br>http://media.ccps.org/Social%20Studies/SS%20Research.html<br>http://questioning.org/rcycle.html<br>**Graphic Organizer websites**:<br>http://eduplace.com/kids/hme/k_5/graphorg/ click on graphic organizer of choice | **SME -** Subject Matter Expert<br>**Subject Matter Expert –** a person who as comprehensive and/or authoritative knowledge or skill in a particular area.<br>**Graphic organizer –** different ways to visually organize information.<br>**Global issues** – issues that impact the Earth as a whole, problems that concern a population throughout the world. |

| | | | |
|---|---|---|---|
| | | http://nb.wsd.wednet.edu/big6/big6_resources.htm click on resources for each step | **Challenges** – a problem or concern that should be addressed.<br>**Real world problems** – problems that actually occur in everyday life. |

STEM Standard of Practice 5: **Engage in Logical Reasoning**

*STEM proficient students will engage in logical reasoning to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

A. Engage in critical thinking.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br><br>• Determine what information is important/relevant when asking and answering complex questions.<br>• Make connections and explain relationships among the questions, global issues and real world problems.<br>• Reflect on one's own thoughts while engaged in decision-making, investigation, and/or problem-solving (e.g. what do I already know about this topic, or KWL strategy).<br>• Recognize and reflect upon the thoughts of others while engaged in decision-making, investigation, or problem-solving. | **Teacher Notes:**<br>○ Generate complex questions about global issues and/or real world problems. (see STEM SOP 4A & 4B).<br>○ Students will conduct a **"Close Read"** of pertinent texts to find main ideas and key details, determine the relevance of information to complex questions, global issues, or real world problems, and determine the accuracy or validity of the information gathered.<br>○ Students must ask, develop and answer questions. These questions will layout the problem, issue, or overarching question in order to guide thinking.<br>○ Students will independently reflect on the information gathered. Students will collaboratively make inferences and evaluate assumptions. Students will analyze and compare information to confirm, refine, and/or develop new questions.<br>○ Students will synthesize information using logical reasoning. They will look for analogies, patterns, and/or attributes to classify | **Professional Development Resources**<br>**The Critical Thinking Community** http://www.criticalthinking.org/pages/for-young-students-elementaryk-6/792 click on student video<br>**Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts** http://mdk12.org/instruction/curriculum/reading/index.html click on CCR Anchor Standard 1; CCSS 2 RI 1-3<br>**A Framework for K-12 Science Education** http://www.nap.edu/catalog.php?record_id=13165 click on<br>**Maryland Common Core State Curriculum** | **logical reasoning**-how things fit together.<br>**Inquiry**- a seeking or request for truth, information, or knowledge – an investigation.<br>**Project-based learning**—an instructional approach that uses a real life context to answer complex questions, global issues, and/or real world problems.<br>**Scientific method**- a method of research in which a problem is identified, relevant data are gathered, a hypothesis is |

| | | | |
|---|---|---|---|
| | information and/or make connections. | **Frameworks – Mathematics** http://mdk12.org/instruction/curriculum/mathematics/index.html click on content choice<br><br>**Engineering by Design Model and Lesson Units 3rd -12th.** http://www.iteea.org/EbD/ebd.htm. explore site | formulated from these data, and the hypothesis is empirically tested<br><br>**Engineering Design Process** - the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic science and mathematics and engineering sciences are applied to convert resources optimally to meet a stated objective.<br><br>**Mathematical practices-** processes and proficiencies as described in a variety of mathematical expertise. |

STEM Standard of Practice 5: **Engage in Logical Reasoning**

*STEM proficient students will engage in logical reasoning to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

B. Evaluate, select, and apply appropriate systematic approaches (scientific investigations, engineering design processes, and/or mathematical practices).

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br><br>• Identify grade appropriate systematic approaches that can be used to ask complex questions, investigate global issues, and solve real world problems or challenges.<br>• Compare systematic approaches to select the best approach to solving real world problems or challenges (e.g. Engineering Design Process, Scientific Process).<br>• Evaluate systematic approaches that can be used to explore questions, global issues or real world problems.<br>• Apply a systematic approach to answer complex questions, investigate global issues or solve real world problems.<br>Evaluate the appropriateness and effectiveness of the selected systematic approaches and continue, modify, or replace the systematic approach. | **Suggested Activities:**<br><br>○ Explain that in the real world there are different systematic approaches people use to solve problems.<br>○ Use a jigsaw/expert group approach to have students identify steps in the different systematic approaches (e.g. Engineering Design Process, Science Practices/Scientific Method, Standards for Mathematical Practices, Research Process/Research Cycle)<br>○ Compare and contrast the STEM Standards of Practice, Standards for Mathematical Practices, Scientific Method, and Engineering Design Process to make generalizations about the ways people solve problems.<br>○ Brainstorm classroom problems and match a systematic approach that could be used to solve the problems.<br>○ Create a problem-solving plan that incorporates appropriate processes. | **Professional Development Resources**<br><br>**Creative Problem Solving Process**<br><br>http://www.creativeeducationfoundation.org/our-process/what-is-cps<br><br>explore site<br><br>**Primary Talent Development Modules from MSDE**<br><br>http://www.ccps.org/teachers/jstemple/Jennifer_Stemple/Introduction.html click on "Process" | **Engineering design process-**<br><br>The process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic science and mathematics and engineering sciences are applied to convert resources optimally to meet a stated objective.<br><br>**Global Issues** – issues that impact the Earth as a whole, problems that concern a population throughout the world. |

| | | | |
|---|---|---|---|
| | Example: Students develop a plan to modify existing desks to accommodate two students, create a better hand held pencil sharpener, create a better pencil, etc. | | **Real world problems** – problems that actually occur in everyday life.<br>**Challenges**-<br>A problem or concern that should be addressed. A competition.<br>**Systematic approach-**<br>Repeatable and learnable through a step by step procedure. |

STEM Standard of Practice 5: **Engage in Logical Reasoning**

*STEM proficient students will engage in logical reasoning to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.*

C. Apply Science, Technology, Engineering, and Mathematics contents to construct creative and innovative ideas.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br>• Ask and answer questions through gathering and synthesizing information to construct new ideas.<br>• Ask questions to explore possible solutions to real world problems.<br>• Engage in projects to create products/models/prototypes that use the knowledge of *science*, *technology*, *engineering,* and *mathematics* content.<br>• Identify creative tools, products and current processes used today, or that may be invented in the future to solve real world problems and/or improve processes or systems.<br>• Develop solutions through creating products/models/prototypes for challenges and real world problems.<br>• Present finished products/models/prototypes through public speaking, displays or exhibits. | **Suggested Activities:**<br>Students identify a complex question, global issue, real world problem and investigate current tools and products used.<br>Students evaluate current products and determine if/how the product can be enhanced.<br>Students use the design process and available materials and tools (such as, rulers, thermometers, magnifiers) to create/adapt models of products to solve real world problems. | **Student Resources**<br>**Scholastic Science World**<br>http://scienceworld.scholastic.com/ explore site<br>**Professional Development Resources**<br>**Engineering Design Loop**<br>http://shop.pitsco.com/ImagePopup.aspx?reftype=1&refid=6020&defimg=11574&pop=1&referer=http%3A//shop.pitsco.com/store/detail.aspx%3FID%3D6020#undefined view graphic<br>**Engineering Design Process**<br>http://www.mos.org/eie/engineering_design.php explore site | **Design** –<br>An iterative decision making process that produces plans by which resources are converted to products or systems that meet human wants or needs or to solve problems. To create or construct according to a plan.<br>**Design process-**<br>A systematic problem-solving strategy, with criteria and constraints, used to develop many possible solutions to solve a problem or satisfy human needs and wants and to winnow (narrow) down the possible solutions to one final choice. |

| | | | |
|---|---|---|---|
| | | | **Create** – build.<br>**Adapt** –make changes or adjust a current design or plan.<br>**Model** – a replica of a larger object or product.<br>**Tool** – device for precise measurement and/or construction.<br>**Innovation** –<br>An improvement of existing technological product, system, or method of doing something. |

STEM Standard of Practice 5: **Engage in Logical Reasoning**

*STEM proficient students will engage in logical reasoning to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

D. Analyze the impact of global issues and problems at the local, national, and international levels.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br>• Identify age appropriate global issues that may impact local/national/global decisions.<br>• Use geographic tools to locate and describe places on Earth. *(SS.2.3.A.1)*<br>• Generate questions that could be asked about the local/national/global issues identified.<br>• Gather information, including data from a variety of print, digital and multimedia resources, to build background knowledge/awareness and answer complex questions about the local/national/global issues identified.<br>• Describe, in detail, and explain global issues past and present.<br>• Describe historical or current events that include *science*, *technology*, *engineering* and *mathematics* content that may have had an impact on changing or making better human life locally or nationally. | **Teacher Notes:**<br>○ Identify age appropriate global issues such as; trash in the waterways, pollution, land use (including farming, parks, development of land for houses), waste management, etc.<br>○ Generate questions that could be asked about the global issues identified.<br>○ Gather information, including data from a variety of print, digital and multimedia resources, to build background knowledge/awareness and answer questions about the global issues identified.<br>○ Logically describe the global issue including key details, how the global issue has changed over time (historically) and any projected impact if no action is taken/changes made.<br>○ Discuss the global issue and relevant information and the impact (real or perceived) on the community, nation and/or world environment. In the discussion address all relevant arguments. (e.g. Earthquakes happen all over the world, and students need to make logical connections to why earthquakes occur and how it impacts people's lives through the eyes of STEM. Marylanders experience an earthquake this past fall. Several things occurred that was related to STEM: some people physically felt the earth shake- scientist began analyzing what happened and why; 2. People were trying to use their cell phones, and they were having difficulty calling love ones-technology was | **Professional Development Resources**<br><br>**Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts**<br>http://mdk12.org/instruction/curriculum/reading/index.html<br>Download Frameworks<br>**click on CCSS 2 W 1; CCSS 2 W2** | **Global issues** – issues that impact the Earth as a whole, problems that concern a population throughout the world.<br><br>**Complex question-** An open ended question that promotes higher order thinking skills and requires students to synthesize information from multiple sources to develop answers.<br><br>**Data-** Collected information which can be quantitative |

| | | | |
|---|---|---|---|
| | affected; 3. The Washington Monument in DC and several building were affected, including some people's personal homes- engineers were called in to assess the damage; and 4. The mathematicians began to measure the earthquakes level and analyze why, what and how the earthquake occurred.) | | (numerical) or qualitative (descriptive). Factual information used as a basis for reasoning, discussion, or calculation. |

STEM Standard of Practice 6: **Collaborate as a STEM team**

*STEM proficient students will collaborate as a STEM team to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

A. Identify, analyze, and perform a science, technology, engineering, and mathematics specific subject matter experts (SME) role.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br><br>• Identify a STEM team's goal before engaging in STEM activities.<br>• Identify examples of specialized jobs in local/national/global settings (e.g. nurses, truck drivers, lawyers, and postal workers). *(SS 2.4.A.2.b)*<br>• Identify science, technology, engineering, and mathematics specific subject matter expert(s) and the knowledge they have that makes them experts in their given area.<br>• Determine which STEM professional each team member will play.<br>• Begin to apply knowledge from *science*, *technology*, *engineering*, and *mathematics* when performing SME roles.<br>• Role-play a scientist, technologist, technician, engineer, and mathematician while engaged in STEM activities/tasks such as working to solve real world problems.<br>• Demonstrate the willingness and positive behaviors to cooperate and collaborate with others. | **Suggested Activities:**<br><br>○ Define the term **collaborate**.<br>○ Brainstorm different types of **teams**, and explore their makeup.<br>○ Brainstorm strategies that enable individuals to successfully work as a member of a team such as Kelso's Choices, Kagan Cooperative Learning Strategies, games and activities that emphasize the importance of each member of a team.<br>○ Investigate through interviews, research, and relevant reading to identify STEM professionals<br>○ Investigate through interviews, research, and relevant reading the way that STEM professionals collaborate to solve problems.<br>○ Identify the different roles that are used and have students practice each of the collaborative roles as they work together to perform STEM tasks. | **Professional Development Resources**<br><br>**Kelso's Choices**<br>http://kelsoschoice.com/ click on "kelso kit" and then "about kelso's choice"<br><br>**Kagan Cooperative Learning**<br>http://www.kaganonline.com/index.php click on "About Us" | **Collaboration** - the ability to work effectively with diverse teams; be helpful and make necessary compromises to accomplish a common goal.<br><br>**Team** – cooperative learning strategies. |

STEM Standard of Practice 6: **Collaborate as a STEM team**

*STEM proficient students will collaborate as a STEM team to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

B. Share ideas and work effectively with a STEM focused multidisciplinary team to achieve a common goal.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br><br>• Explain how rules promote orderliness, fairness, responsibility, privacy, and safety. *(SS.2.1.A.1.b)*<br>• Collaboratively generate ideas to achieve a common goal by:<br>  ◦ Brainstorming ideas.<br>  ◦ Asking questions and listening to questions from others.<br>  ◦ Sharing ideas with others.<br>  ◦ Receiving ideas and suggestions of others.<br>• Develop a plan of action in order to achieve a common goal by:<br>  ◦ Working cooperatively with others.<br>  ◦ Identifying a goal.<br>  ◦ Designing a plan /selecting a systematic approach to use to meet set goal.<br>  ◦ Implementing the plan/systematic approach to meet set goal<br>  Sharing plans/approaches and finished products/models/prototypes with others. | **Teacher Notes:**<br>○ Set up teams where each member has a different SME role.<br>○ Brainstorm appropriate complex questions, global issues, and challenges in real world problems.<br>○ Student groups select one of the above, and ask questions (e.g. What do you think; How did you make the… work? I liked when you…) from the perspective of different disciplines based on students SME role (consider rotating SME roles as students work through this process).<br>○ Use a t-chart to match the disciplines to the questions asked. (e. g. Social Studies – What responsibilities to citizens have to protect wild life?)<br>○ Review with students the purpose of creating a problem-solving plan as a logical way to solve a problem. Define the term "plan" with students. Build student background knowledge by showing and comparing different discipline's plans (e.g. writing process, steps to solving a mathematical problem, the scientific method, 5 Step Engineering Design Process).<br>○ Have students develop a plan to solve the identified complex question, global issue, and real world problems. | **Student Resources**<br>**Discover Engineering** www.discoverengineering.org click on "What's Engineering"<br>**Professional Development Resources**<br>**Discover Engineering** www.discoverengineering.org click on "What's Engineering" | **SME -** Subject Matter Expert<br>**Subject Matter Expert –** a person who as comprehensive and/or authoritative knowledge or skill in a particular area.<br>**Plan** - a scheme or method of acting, doing, proceeding, making, etc., developed in advance. |

STEM Standard of Practice 6: **Collaborate as a STEM team**

*STEM proficient students will collaborate as a STEM team to answer complex questions, to investigate global issues, and to develop solutions for challenges and real world problems.*

C. Listen and be receptive to ideas of others.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br>• Listen to details and ideas generated by the group and respond appropriately to others ideas<br>• Ask questions to understand ideas and thoughts of others.<br>• Identify strategies that promote active listening.<br>• Synthesize information and use others ideas as appropriate when completing a team task.<br>• Identify and demonstrate appropriate social skills necessary for working in a cooperative group, such as sharing concern, care and respect among group members. *(SS.2.2.C.1.a)* | **Teacher Notes:**<br>○ Review the concept of "listening" with students. Have students compare hearing with listening. Identify strategies to promote active listening skills. Discuss when and why listening might be important. (e.g. directions to a new place, safety/fire drill, civil defense drill, bus emergency drill, other procedures). Play a game such as telephone/gossip to illustrate what happens when people do not listen well.<br>○ Structure an environment that fosters respect and acceptance for each other. Use cooperative learning strategies to teach students how to work collaboratively and to be accepting of each others" ideas.<br>○ As a STEM team, think critically by: Generating complex questions about global issues and/or real world problems; Gathering information; Developing and/or refining questions; Looking for relationships and connections among the questions, global issues and/or real world problems.<br>○ Given a complex question, global issue, real world problem, SME teams brainstorm possible solutions by exchanging ideas with other SME teams and or expert groups about the topic. SME teams analyze ideas and reflect or apply appropriate solutions to achieve the SME team's goal. | **Student Resources**<br>**Website with listening games**<br>http://www.moxiementalhealth.com/2011/02/20/games-to-teach-your-child-how-to-listen/ view site<br>**Professional Development Resources**<br>**Active Listening Teacher Resources**<br>http://www.mindtools.com/CommSkll/ActiveListening.htm view page and video<br>http://www.taftcollege.edu/lrc/class/assignments/actlisten.html view page<br>http://www.littleonesreadingresource.com/ | **SME -** Subject Matter Expert<br>**Subject Matter Expert –** a person who as comprehensive and/or authoritative knowledge or skill in a particular area.<br>**Listening** - to hear something with thoughtful attention: give consideration.<br>**Active listening -** Active listening is a way of listening that focuses entirely on what the other person is saying and confirms understanding of both the content of the message and the emotions and feelings underlying the message to ensure |

| | | | |
|---|---|---|---|
| | | teaching-children-listening-skills.html view page<br><br>http://www.hrea.org/erc/Library/primary/Opening_the_Door/workshop2.html view page | that understanding is accurate.<br><br>**Critical thinking –** disciplined thinking that is clear, rational, open-minded, and informed by evidence<br><br>**Divergent questions -** question with no specific answer, but rather exercise one's ability to think broadly about a certain topic. |

STEM Standard of Practice 6: **Collaborate as a STEM team**

*STEM proficient students will collaborate as a STEM team to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

D. Analyze career opportunities that exist in a variety of STEM fields relevant to the STEM focused multidisciplinary team's goal.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br><br>• Identify and list several types of STEM professionals.<br>• Research the many roles STEM professional perform in the work place.<br>• Identify specific behaviors and knowledge needed by many STEM professionals to perform their job(s).<br>• Identify and explain how different STEM professionals perform their roles to work together to solve real world problems. | **Teacher Notes:**<br>○ Using a graphic organizer such as K- W-L (Know, Where I can find the information, What I Learned), O-W-L (Observed, Want to Know, Learned), have SME teams brainstorm all of the STEM careers they can think of. Next, encourage SME teams to identify data sources that could be used to find out more STEM careers. You may wish to invite local STEM professionals (e.g. scientist, technologist, engineer and mathematician etc.) from your community in as guest speakers. Have students identify additional STEM careers based on the information they have read/heard.<br>○ State global issues or real world problems and have students identify which STEM professionals would address them.<br>○ Provide students multiple opportunities to act/practice acting like the different STEM professionals they learned about as they complete transdisciplinary lessons/lesson activities.<br>○ When answering complex questions, and/or solving global issues, or real world problems have students identify and explain the content knowledge from specific discipline that was necessary to help them answer the question/solve the problem. Students would name the discipline and the content needed to solve the problem. (e.g. When addressing the global problem of trash n our waterways, students might say that math content was needed for the data gathering, science content was needed to identify the current flow, social studies content was needed to read the maps, technology -GPS/Geospatial technologies is used to monitor the data buoys, etc.)<br>○ Given a complex questions, global issues, real world problems, SME teams work collaboratively to attempt answers/solutions. SME teams identify the content knowledge they used/will need to use to solve the problem. | **Recourses related to the reading of Science, Technology, Engineering and Mathematics contents, practices, and/or processes.** | **Transdisciplinary** In the transdisciplinary approach to integration, teachers organize curriculum around student questions and concerns. Students develop life skills as they apply interdisciplinary and disciplinary skills in a real-life context. Two routes lead to transdisciplinary integration: project-based learning and negotiating the curriculum. (Drake & Burns, 2005)<br><br>**SME -** Subject Matter Expert<br><br>**Subject Matter Expert –** a person who as comprehensive |

| | | | |
|---|---|---|---|
| | | | and/or authoritative knowledge or skill in a particular area.<br><br>**Global issues** – issues that impact the Earth as a whole, problems that concern a population throughout the world.<br><br>**Challenges** – a problem or concern that should be addressed.<br><br>**Real world problems** – problems that actually occur in everyday life.<br><br>**Complex question-**<br><br>An open ended question that promotes higher order thinking skills and requires students to synthesize information from multiple sources to develop answers. |

STEM Standard of Practice 7: **Apply Technology Strategically**

*STEM proficient students will apply technology appropriately to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

A. Identify and understand technologies needed to develop solutions to problems or construct answers to complex questions.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br><br>• Define and explain the term technology.<br>• Identify examples of technology used by consumers (e.g. automobiles, cameras, telephones, microwaves, televisions, clocks and computers). *(SS.2.4.A.3.a)*<br>• Identify ways people use technology to solve real world problems. | **Teacher Notes:**<br>○ Teach students that anything man made can be considered technology: various types of communication devises: rotary, button and cell phones, desktop, laptop, computers, smart board, IPad; various types of cameras: instant film, Polaroid photo, and digital various simple tools pencils, straws, sticks, paper, etc.<br>○ **Suggested Activities:**<br>○ Have students brainstorm all the things that they use every day. Have them identify which ones represent technology.<br>○ OR<br>○ Gather pictures of examples of technology for students to sort and describe the technology they have identified OR have students cut out pictures from magazines or newspapers that represent technology.<br>○ Created a shared definition of technology.<br>○ Students consider jobs that they know of (i.e. their parent's jobs, jobs at school, etc) and determine the tasks that are required of the job. In determining the job tasks students can identify the technologies required to complete the job:<br>  ○ Scientist - microscope<br>  ○ Teacher - chalk board/white board/interactive board<br>  ○ Trash Man - trash compactor<br>  ○ Artist - paint brush<br>  ○ Chef – oven, stove, knives<br>○ e.g. anything man made can be considered technology: various types of communication devises: rotary, button and cell phones, desktop, laptop, computers, smart board, IPad; various types of cameras: instant film, Polaroid photo, and digital various simple tools pencils, straws, sticks, paper, etc.) | **Professional Development Resources**<br><br>**Standards for Technological Literacy** http://www.iteea.org/TAA/PDFs/xstnd.pdf **click and download pdf** | **Technology** – Human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities.<br><br>**Tool** – device for precise measurement and/or construction.<br><br>**Real world problems** – problems that actually occur in everyday life. |

STEM Standard of Practice 7: **Apply Technology Strategically**

*STEM proficient students will apply technology appropriately to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

B. Analyze the limits, risks, and impacts of technology.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br><br>• Identify limits of technology.<br>• Identify factors that impact the use of technology.<br>• Identify risks in using technology.<br>• List and explain the limitations of technology.<br>• Conclude that all technology has positive and negative impacts and explain several. | **Teacher Note**:<br>○ Identify limitations when using technology (e.g. limited access-not enough computers for everyone)<br>○ Identify risks of using technology or relying on technology (e.g. improper usage may break)<br>○ Identify the impacts of using technology (e.g. typing on the computer may negatively or positively affect hand writing skills)<br><br>**Suggested Activities:**<br>○ As a class, use a T-chart to consider the implications, both positive and negative when using technology, (e.g. implications of driving a car. Pro - gets you from one place to another faster than walking. Con - lots of people driving at the same time causes traffic.)<br>○ Students brainstorm technologies they use every day and verbally identify *limits* to utilizing those technology.<br>○ Students can consider limitations such as computer lab space and/or time to use the lab at a school. Other students can consider community, state and world considerations that may limit technology utilization such as secure Wi-Fi accessibility at local establishments to the cost related to equal access to technology tools people may use (a computer in a home or a mobile device). | **Professional Development Resources**<br><br>**Graphic Organizer websites:**<br>http://eduplace.com/kids/hme/k_5/graphorg/ click on graphic organizer of choice | **Limit** – a boundary.<br><br>**Access** – a way or means of approach.<br><br>**Implication** – something suggested as naturally to be inferred or understood.<br><br>**Risk**-<br>A factor, thing, element, or course involving uncertain danger; a hazard. |

STEM Standard of Practice 7: **Apply Technology Strategically**

*STEM proficient students will apply technology appropriately to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

C. Engage in responsible/ethical use of technology.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br><br>• Know and apply rules when using a variety of technologies *(See MTLSS 1 & 2.2.B.1)*.<br>• Apply the appropriate use ~ state and district policy *(See MTLSS 1&2. 2.B.1a)*<br>• Recognize and apply the policy of copyright protection *(See MTLSS 2.2.B.2a; MS SLM 2-3. 5.1f*).<br>• Develop positive social behaviors when using technology.<br>• Apply respectful and responsible behaviors while using technology *(See MS SLM 2-3. 5. A.2b)*.<br>• Identify and apply digital etiquette behaviors *(See MTLSS 2.A.2a*). | **Teacher Notes:**<br>○ Use the Maryland Technology Literacy Standard for Students #2: Digital Citizenship to better understand the standard<br>○ Explain netiquette and have students demonstrate the concept as they work online.<br>○ Be respectful of others rights<br>○ Consider the feelings of others<br>○ Respect others privacy<br>○ Be responsible<br>○ Be polite and positive<br>○ Help others<br>○ Make students aware of and comply with Cyberethics:<br>○ Beware of strangers online<br>○ Avoid inappropriate material<br>○ No hacking<br>○ No pirating<br>○ Respect others privacy<br>○ No cyber bullying<br>○ Work to prevent violations<br>○ Comply with copyright policies<br>**Suggested Activities:**<br>○ Review classroom rules and discuss why rules are important. Have students identify the impact of not complying with classroom rules.<br>○ Discuss the importance of and encourage | **Student Resources**<br><br>**Cyberethics—Computer Crime & Intellectual Property Section United States Department of Justice** http://www.cybercrime.gov/rules/kidinternet.htm explore<br><br>**Cyber bullying site** http://www.cybersmart.gov.au/<br><br>**explore site copyright** http://www.copyrightkids.org/ explore site<br><br>**Professional Development Resources**<br><br>**Maryland Technology Literacy Standards** http://www.montgomeryschoolsmd.org/departments/techlit/ click to download the standards | **Netiquette** - etiquette governing communication on the Internet.<br><br>**Digital etiquette** - The conventional rules or personal behavior pertaining to courteous online practices. For example, considering sensitivities, multiculturalism, diversity, conventions, and tone.<br><br>**Cyberethics –** ethics related to computer usage.<br><br>**Ethics** – moral principles that |

| | | | |
|---|---|---|---|
| | students to comply with district "Acceptable Use Policy" for technology.<br>○ Choose a violation of Cyberethics and analyze the human and legal consequences of the act. Students can conduct a mock trial to examine the consequences. | **Netiquette for Kids Boston Public Library** http://www.bpl.org/kids/netiquette.htm explore page<br><br>**Cyberethics—Computer Crime & Intellectual Property Section United States Department of Justice** http://www.cybercrime.gov/rules/cybercitizen4.htm explore site<br>**Cyberethics Institute Ten Commandments of Cyberethics** http://www.educationworld.com/a_lesson/lesson-plan-booster/cyber-ethics.shtml explore page<br>**Cyber Bullying Sites**<br>http://www.stopcyberbullying.org/ click on "what is it"<br>http://facs.pppst.com/bullying.html explore links<br>http://cybersmartcurriculum.org/cyberbullying/lessons/<br>http://www.cybersmart.gov.au/<br>copyright http://www.copyrightkids.org/ explore site | govern an individual or groups behaviors.<br>**Hacking** – breaking into computer systems.<br>**Pirating** – stealing computer software.<br>**Cyber bullying** – harassing or being mean to someone in an online environment.<br>**Copyright** - The exclusive legal rights to reproduce, publish, sell, or distribute the matter and form of something. |

STEM Standard of Practice 7: **Apply Technology Strategically**

*STEM proficient students will apply technology appropriately to answer complex questions, to investigate global issues, and to develop solutions for challenges, and real world problems.*

D. Improve or create new technologies that extend human capacity.

| Grades: First through Second | Instructional Notes and Examples | Resources | Glossary |
|---|---|---|---|
| **Essential Skills and Knowledge**<br>By the end of grade 2, students will be able to:<br><br>• Identify examples of technology used by consumers (e.g. automobiles, cameras, telephones, microwaves, television, and computers). *(MTLSS 2.4.B.1a;SS.4.2.3a)*<br>• List ways people can use technology to better human life. *(MTLSS 1 & 2. 2.A.1c*)<br>• Describe the relationship among events and technologies in a variety of timelines. *(SS.2.5.A.1.b)*<br>• Examine differences between past and present time technologies. *(MTLSS 2.2.A.1b;SS.2.5.A.1)*<br>• Describe how technology has changed over time.<br>• Explain why technology rapidly changes.<br>• Draw and build a model showing new uses of technology or technological tools.<br>Examine how technology affects the way people live, work, and play. *((MTLSS 1 & 2. 2.A.1c;SS.4.2.3)* | **Teacher Notes:**<br>○ Examine a variety of technologies and discuss their common usages.<br>○ Explore complex questions, global issues, or real world problems not commonly associated with these technologies.<br><br>**Suggested Activities:**<br>○ Explore ways in which these technologies can be used to address these novel situations. Create models to show any needed enhancements or new technologies to address the novel situations.<br>Use Science, Technology, Engineering and Mathematics standards and / or practices to complete the model.<br>○ Write an opinion paper to describe what type of technology best meets the novel situation. Give evidence to support your opinion, as well as a detailed description of the elements of the technology.<br>○ Select a current piece of technology. Model and then support students / groups of students as they research the need that existed which led to its creation and identify how it extended the capabilities of mankind. Identify any innovations that came before and show the | **Professional Development Resources**<br><br>**Kids Design the Future**<br>**University of Maryland**<br>http://www.cs.umd.edu/hcil/kiddesign/design_process.shtml view page<br><br>**Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts**<br>http://mdk12.org/instruction/curriculum/reading/index.html download Frameworks; click on CCSS 2 W 1<br><br>**A Framework for K-12 Science Education**<br>http://www.nap.edu/catalog.php?record_id=13165 click on | **Technology** –<br>Human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities.<br><br>**Technological tool**-<br>A device used by humans to complete a task. These tools may include rulers, protractors, computer softwares, CAD programs, etc. |

| | | | |
|---|---|---|---|
| | sequence of their development. (e.g. Uber app for SMART phones to help you find a taxi cab, bike sharing in major cities, credit card parking meters, pay at the pump gas stations) Brainstorm current deficits or natural progressions that this technology cannot address. Propose adaptations or new technologies that might logically follow this technology in the future. (extension: create models of new technology). | **Maryland Common Core State Curriculum Frameworks – Mathematics** http://mdk12.org/instruction/curriculum/mathematics/index.html click on | |

**Appendix A**

**Abbreviations**

**Grades K - 5**

**CCSS W.K:5:** Common Core State Standards Writing Grades K-5
**CCSS RI.K.5:** Common Core State Standards Reading Informational Text Grades K5
**CCSS SL.K.5:** Common Core State Standards Speaking and Listening Grades K-5
**CCSS L.K.5**: Common Core State Standards Language Grades K-5
**CCSS RL.K:5:** Common Core Reading Literature Grades K-5
**SS K: 5:** Maryland State Curriculum-Social Studies K-5
**MS SLM K-5:** School Library Media State Curriculum K-5
**MTLSSS** – Maryland Technology Literacy Standards for Students Grades K-5

**Online Maryland State Curriculum-Content Standards**

| Content | Standards Online Websites |
|---|---|
| **Science and Engineering** | **A Framework for K:12 Science Education** http://www.nap.edu/catalog.php?record_id=13165 |
| **Technology** | **Maryland Technology Literacy Standards for Students K:8** http://marylandpublicschools.org/NR/rdonlyres/CFAE6DE8:94E4:4D72:A1DE:50061B2B2A05/13089/MTLSSSComplete1.pdf |
| **International Technology and Engineering Educator's Association (ITEEA)** | **ITEEA** http://www.iteaconnect.org/TAA/PDFs/ListingofSTLContentStandards.pdf **Standards for Technology Literacy: Content for the Study of Technology** http://www.iteaconnect.org/TAA/PDFs/xstnd.pdf |
| **Mathematics** | Maryland Common Core State Curriculum Frameworks – Mathematics http://mdk12.org/instruction/curriculum/mathematics/index.html |
| **Reading / English Language Arts** | **Maryland Common Core State Curriculum Frameworks – Reading / English Language Arts** http://mdk12.org/instruction/curriculum/reading/index.html |
| **School Library Media State Curriculum** | **School Library Media State Curriculum** http://www.marylandpublicschools.org/NR/rdonlyres/EC67FB12-FE6B-464A-A2AD-D0C6307773E3/26323/MS_SLM_SC_Accepted_GRpk8.pdf |
| **Social Studies** | **Social Studies** http://mdk12.org/instruction/curriculum/social_studies/index.html |
| **Fine Arts** | **Fine Arts** http://www.mfaa.msde.state.md.us/source/MDFA_index.asp |

**Appendix B**

## Elementary School STEM Standards of Practice Framework and Instructional Guide Glossary

**Academic Vocabulary**: Terms necessary for understanding ideas across curricular areas.

**Access**: A way or means of approach.

**Accuracy:** Degree of conformity of a measure to a standard value.

**Action plan**: A series of steps and/or activities that must be successfully completed to achieve a goal.

**Active listening**: Listening that focuses entirely on what the other person is saying and confirms understanding of both the content of the message and the emotions and feelings underlying the message to ensure that understanding is accurate.

**Analogy:** A comparison between two things for a purpose of explanation or clarification; see simile, metaphor.

**Analysis:** Identification and evaluation of data, material, and sources for quality of content, validity, credibility and relevance; student compares and contrasts sources and findings and generates summaries and explanations of source materials.

**Analyze:** To examine something in great detail in order to understand it better or discover more about it.

**Anecdotal record:** Significant incidents or specific, observable behaviors can be recorded by teachers in anecdotal records. These records provide cumulative information about students' development in the learning objectives of the language arts as well as their physical and social growth and development. By systematically collecting and analyzing anecdotal comments, teachers can evaluate students' progress and abilities to use language and then plan appropriate instruction.

**Anecdotes:** Brief interesting or amusing life stories used to make a point.

**Applies technology to task:** Understands the overall intent and the proper procedures for setting up and operating machines, including computers and their programming systems.

**Apply:** To bring into action; use; employ.

**Argument**: A purpose for writing using reasons or evidence to support a claim or opinion.

**Brainstorming:** A method of shared problem solving in which all members of a group spontaneously and in an unrestrained discussion generate ideas.

**Challenges**: A problem or concern that should be addressed. A competition.

**Close read**: Observing facts and details about a text and interpreting those details.

**Collaboration**: The ability to work effectively with diverse teams; be helpful and make necessary compromises to accomplish a common goal.

**Communication**: The successful transmission of information through a common system of symbols, signs, behavior, speech, writing, or signals.

**Compare and contrast:** Organizational structure in which the difference and similarities across or within two texts are highlighted or could demonstrate a preference for one thing over another.

**Complex question:** An open ended question that promotes higher order thinking skills and requires students to synthesize information from multiple sources to develop answers.

**Complex text**: A text whose complexity is determined by quantitative, qualitative and reader task components.

**Computer literacy**: The terminology and range of skills required to successfully use computers and other devices associated with computers.

**Connection:** The relationship of something with its context.

**Constraint:** A limit to the design process. Constraints may be such things as appearance, funding, space, materials, and human capabilities.

**Content:** The subjects or topics covered in a book or document.

**Copyright:** The exclusive legal rights to reproduce, publish, sell, or distribute the matter and form of something.

**Create:** To bring something into existence; to use imagination to invent things or produce works of art; to result in something or make something happen.

**Creative problem solving:** Process to identify problems, generate ideas, and create an action plan to solve the problem.

**Creative thinking or ideas**: The ability or power used to produce original thoughts and ideas based upon reasoning and judgment.

**Critical reading:** Means reading with the goal of finding deep understanding of a material, whether it is fiction or nonfiction. It is the act of analyzing and evaluating what you are reading as you progress, or as you reflect back.

**Critical thinking**: The ability to acquire information, analyze, and evaluate it, and reach a conclusion or answer by using logic and reasoning skills.

**Cyber bullying**: Harassing or being mean to someone in an online environment.

**Cyberethics:** Ethics related to computer usage.

**Data**: Collected information which can be quantitative (numerical) or qualitative (descriptive). Factual information used as a basis for reasoning, discussion, or calculation.

**Decision-making:** The act of examining several possible behaviors and selecting from**.**

**Demonstrate:** Explain or describe how something works or how to do something; show or prove something clearly and convincingly.

**Design process:** A systematic problem-solving strategy, with criteria and constraints, used to develop many possible solutions to solve a problem or satisfy human needs and wants and to winnow (narrow) down the possible solutions to one final choice.

**Design**: An iterative decision making process that produces plans by which resources are converted to products or systems that meet human wants or needs or to solve problems. To create or construct according to a plan.

**Develop:** To elaborate or expand in detail.

**Digital etiquette**: The conventional rules or personal behavior pertaining to courteous online practices. For example, considering sensitivities, multiculturalism, diversity, conventions, and tone.

**Discipline:** A formal branch of knowledge or teaching (e.g., biology, geography, and engineering) that is systematically investigated, documented, and taught.

**Divergent questions**: Open ended questions that have more than one correct answer, or more than one correct way to solve them.

**Domain specific vocabulary**: The terminology of a particular field of knowledge or content.

**Educational technology**: Using multimedia technologies or audiovisual aids as a tool to enhance the teaching and learning process.
**Effectively:** In an effective manner; "these are real problems that can be dealt with most effectively by rational discussion.
**Engineer:** A person who is trained in and uses technological and scientific knowledge to solve practical problems.

**Engineering design process**: The process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic science and mathematics and engineering sciences are applied to convert resources optimally to meet a stated objective.

**Engineering design:** The systematic and creative application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems.

**Engineering**: The profession of or work performed by an engineer. Engineering involves the knowledge of the mathematical and natural sciences gained by study, experience, and practices that are applied with judgment and creativity to develop ways to utilize materials and forces of nature for the benefit of mankind.

**Environmental print**: The identification or recognition of print or non-print in familiar settings.
**Essential skills:** What students need in order to master a specific STEM Standards of Practice Student proficiency.

**Ethics:** Moral principles that govern an individual or groups behavior.

**Ethic**s: A set of moral principals or values; A theory or system of moral values (the present-day materialistic ethic); Plural but singular in construction; The principal of conduct governing a individual or group.
**Etiquette:** The conduct or procedure required by good breeding or prescribed by authority to be observed in social or official life.
**Evaluate:** To consider or examine something in order to judge its value, quality, importance, extent, or condition.
**Evaluation:** Judge the product (effectiveness); judge the process (efficiency).

**Evidence**: Facts, figures, details, quotations, or other sources of data and information that provide support for claims or an analysis that can be evaluated by others; should appear in a form and be derived from a source widely accepted as appropriate to a particular disciplines, as in details or quotations from a text in the study of literature and experimental results in the study of science.

**Expository text:** The nature of exposition; serving to expound, set forth, or explain.

**Facilitate**: To help bring about learning or make learning easier.

**Figurative language/meaning**: A type of language that does not mean explicitly what it says; contains words and phrases that require a reader to make inferences and use his/her imagination in order to create a more vivid image or real experience.

**Figures of speech**: a non-literal expression in which the meaning is ironic, metaphorical, or rhetorical.

**Foundation questions:** Questions that are derived from overarching questions. These are the "What is…" questions. Their answers are absolute and are usually singular (only one right answer).

**Gather:** To learn from information given; conclude or assume.

**Global issues**: Issues that impact the Earth as a whole, problems that concern a population throughout the world. A global issue is an issue that's going on all over the world meaning it not only going on in a certain place. For example: global warming is a global issue, not like the oil spill it hasn't affected the whole world.

**Graphic organizer**: Different ways to visually organize information.

**Hypothesis:** A tentative answer to a question, from which testable prediction can be generated.

**I Do, We Do, You Do:** An instructional strategy where practice is scaffolded to support the learners needs. The teacher models for students, students work in groups for guided practice and then finally students work.

**Identify:** To recognize somebody or something and to be able to say who or what he, she, or it is.

**Implication:** Something suggested as naturally to be inferred or understood.

**Independent(ly):** A student performance done without scaffolding from a teacher, other adult, or peer.

**Inference:** A logical guess based on text evidence and the reader's prior knowledge.

**Information:** Knowledge gained through study, communication, research, instruction, etc.; factual data.

**Informational text**: Includes literary non-fiction, expository text, technical text, procedural text, and functional text.

**Innovation**: An improvement of existing technological product, system, or method of doing something.

**Innovative:** Demonstrating originality and inventiveness in work; developing, implementing and communicating new ideas to others; being open and responsive to new and diverse perspectives.

**Inquiry based learning:** Learning that can be applied to all disciplines. Individuals need many perspectives for viewing the world. Such views could include artistic, scientific, historic, economic, and other perspectives. While disciplines should interrelate, inquiry learning includes the application of certain specific "ground rules" that insure the integrity of the various disciplines and their world views.

**Inquiry**: A seeking or request for truth, information, or knowledge – an investigation.

**Integrate**: Combine knowledge from multiple disciplines.

**Interdisciplinary:** Across content or discipline areas.

**Investigation:** An examination or inquiry into something, especially a detailed one that is undertaken officially, or the act of undertaking an examination.

**Issue:** Point of matter or dispute which is special to public importance.

**Language of the discipline**: The language professionals in a given field use to communicate with their peers.

**Lesson module:** A unit of education or instruction with a relatively low student-to-teacher ratio, in which a single topic or a small section of a broad topic is studied for a given period of time.

**Lesson:** A period of instruction; a class. An assignment or exercise in which something is to be learned. An act or instance of instructing/teaching.

**Limit**: A boundary.

**Listening:** To hear something with thoughtful attention, to give consideration.

**Local:** In close proximity to a given location, community.

**Logic:** The ability to use reasoning to determine relationships among propositions in terms of implication, contradiction, contrariety, and conversion.

**Logical reasoning**: How things fit together.

**Mathematical practices:** Processes and proficiencies as described in a variety of mathematical expertise.

**Mathematics**: The science of numbers and their operations, interrelations, combinations, generalizations, and abstractions and of space configurations and their structure, measurement, transformations, and generalizations.

**Metacognition:** Is defined as "cognition about cognition", or "knowing about knowing." It can take many forms; it includes knowledge about when and how to use particular strategies for learning or for problem solving.

**Model**: A replica of a larger object or product.

**Module:** A self-constrained unit.

**Netiquette:** Etiquette governing communication on the Internet.

**New:** Unfamiliar or novel to the student.

**Nonfiction/informational text:** The branch of literature comprising works of narrative prose dealing with or offering opinions or conjectures upon facts and reality, including biography, history, and the essay.

**Opinion**: A view or judgment formed about something.

**Overarching Questions**: Questions that are not answerable with finality in a brief sentence. Typically, further research is required to answer overarching questions. Their aim is to stimulate thought, to provoke inquiry, and to spark more questions.

**Piracy:** Stealing computer software.

**Plan:** A scheme or method of acting, doing, proceeding, making, etc., developed in advance.

**Precisely:** Used to indicate that something is stated exactly; with absolute accuracy.

**Primary source**: A first-hand account of an event.

**Prior knowledge:** Information that a student knows before a lesson/instruction/research/exploration.

**Problem solving**: The process of understanding a problem, devising a plan, carrying out the plan, and evaluating the plan in order to solve a problem or meet a need or want.

**Problem-base learning:** (PBL) is a student-centered pedagogy in which students learn about a subject in the context of complex, multifaceted, and realistic problems (not to be confused with project-based learning).

**Problems**: An issue concerning one or more people.

**Proficient:** Performance that meets the criterion established in the Standards as measured by a teacher or assessment.

**Proficiently**: A student performance that meets the criterion established in the Standards as measured by teacher or assessment.

**Project based learning:** Is a systematic teaching method that engages students in learning important knowledge and 21st century skills through an extended, student-influenced inquiry process structured around complex, authentic questions and carefully designed products and learning tasks.

**Prototype:** A full-scale working model used to test a design concept by making actual observations and necessary adjustments.

**Question:** A request for information or for a reply, which usually ends with a question mark if written or on a rising intonation if spoken.

**Real world problems:** Problems that actually occur in everyday life.

**Real world:** The realm of practical or actual experience, as opposed to the abstract, theoretical, or idealized sphere of the classroom, laboratory, etc.

**References:** A spoken or written comment that either specifically mentions or calls attention to somebody or something or is intended to bring somebody or something to mind.

**Refine**: To clarify, improve, and polish a research question or information need throughout the inquiry process.

**Relevant ideas**: Any thoughts, conceptions, or notions pertinent to a learning activity.

**Relevant information**: Knowledge gained through study, communication, research, instruction etc. pertinent to a learning activity.

**Research:** Identification and utilization of appropriate strategies to explore and answer problems and to conduct research on a range of questions.

**Researchable question**: A clear and concise question that has a means of which to be answered through investigation.

**Risk**: A factor, thing, element, or course involving uncertain danger; a hazard.

**Role:** The actions and activities assigned to or required or expected of a person or group; "the function of a teacher"; "the government must do its part"; "play its role."

**Runoff:** The portion of precipitation on land that ultimately reaches streams often with dissolved or suspended material.

**Science:** Knowledge about or study of the natural world based on facts learned through experiments and observations.

**Scientific method**: A method of research in which a problem is identified, relevant data are gathered, a hypothesis is formulated from these data, and the hypothesis is empirically tested.

**Self-directed:** Monitoring one's own understanding and learning needs; demonstrating initiative to advance professional skill levels; **defining, prioritizing and completing tasks without direct oversight;** demonstrating commitment to lifelong learning.

**Skill:** An ability that has been acquired by training or experience.

**Solution**: The successful action of solving a problem, the answer that fixes the problem.

**Source**: A work, etc. supplying information or evidence (esp. of an original primary character) as to some fact, event, or series of these. Could also be a person supplying information, an informant, a spokesman.

**Strategic reader**: A student who naturally internalizes the reading process – before, during and after reading strategies.

**Strategies:** A plan, method, or series of maneuvers or stratagems for obtaining a specific goal or result.

**Subject matter expert:** A person who as comprehensive and/or authoritative knowledge or skill in a particular area or topic.

**Synthesis:** Organize from multiple sources; present the information.

**Synthesize:** To merge new information with prior knowledge, to form a new idea, perspective, or opinion: to generate insight.

**Systematic approach:** Repeatable and learnable through a step by step procedure.

**Team**: Cooperative learning strategies.

**Technical audiences**: Audience consisting of practitioners in the field of engineering, technology, design, business, and other workforce-related disciplines.

**Technical information:** Belonging to or involving a specialized subject, field, or profession.

**Technical texts**: Formula reading relating to or characteristic of a particular field.

**Technical writing:** Treating a document with the goal of providing clear and concise information, rather than entertainment or story telling; a technical document/report incorporates diagrams and multi-media information to provide technical information.

**Technological tool**: A device used by humans to complete a task. These tools may include rulers, protractors, computer softwares, CAD programs, etc.

**Technology literacy**: The ability to use, manage, understand and assess technology.

**Technology**: Human innovation in action that involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities.

**Test:** A method for collecting data; a procedure for critical evaluation.

**Tool:** Device for precise measurement and/or construction.

**Topic:** Subject of conversation or discussion.

**Transdisciplinary**: In the transdisciplinary approach to integration, teachers organize curriculum around student questions and concerns. Students develop life skills as they apply interdisciplinary and disciplinary skills in a real-life context. Two routes lead to transdisciplinary integration: project-based learning and negotiating the curriculum. (Drake & Burns, 2005)

**Units:** Are a series of lessons that address the same resource or theme.

**Utilize**: To put to use, especially to find a profitable or practical use for

**Weigh:** Assess the importance of (a contribution) in making a decision.

**Appendix C**

## References

**"School Improvement in Maryland"—Glossary***

English Language Arts http://www.mdk12.org/instruction/curriculum/reading/glossary.shtml

School Library Media http://mdk12.org/instruction/curriculum/library_media/index.html

Social Studies http://mdk12.org/assessments/vsc/social_studies/bygrade/glossary.shtml

Technology Education http://mdk12.org/instruction/curriculum/technology_education/index.html

21st Century Skills http://www.p21.org/

**Online References**


- Active Listening - Adapted from http://wik.ed.uiuc.edu/index.php/Active_listening
- Copyright - Adapted from http://www.copyrightkids.org/
- Creative Problem Solving Process - http://www.creativeeducationfoundation.org/our-process/what-is-cps
- Critical thinking - Adapted from http://dictionary.reference.com/browse/critical+thinking
- Cyberethics - Adapted from https://docs.google.com/viewer?a=v&q=cache:Ks6kijGdLylJ:iris.nyit.edu/~mtehrani/Week2_assignment1_MTehrani.pdf+&hl=en&gl=us&pid=bl&srcid=ADGEESiedhumnaTwb2KEVqbjj95ITRopzPbbN9pBTYmr7xX10KJxKeV3_xjSSYaB_iNG8vGW1vmVL1bXpxQwTTnQTsnxjSHtMOqeFuqWYwMos0vRmT3MzYNJcV9kbpsUJ80plLrFiCQL&sig=AHIEtbTBP_vhfRFUNC0QY4fltkm3epyCEw&pli=1
- Cybyer Bullying - Adapted from http://www.stopcyberbullying.org/
- "Dictionary.com" http://dictionary.reference.com/
- Divergent questions - Adapted from http://www4.uwsp.edu/education/lwilson/learning/quest2.htm
- Engineering Design Process - Adapted from http://www.me.unlv.edu/Undergraduate/coursenotes/meg497/ABETdefinition.htm
- Etiquette - Adapted from http://www.merriam-webster.com/dictionary/etiquette
- Global Issues -Adapted from http://dictionary.reference.com/browse/issue?s=t
- Hacking - Adapted from http://www.techterms.com/definition/hacker
- Implication - Adapted from http://dictionary.reference.com/browse/implication
- Issue - Adapted from http://dictionary.reference.com/browse/issue?s=t

- Jigsaw/expert group - definition adapted from: A cooperative learning structure where group members become experts in a given topic and teach the other members of the group. http://www.jigsaw.org (please add this link to our resource column) Engineering Design Cycle - (Change to Engineering Design Process and delete Engineering Design Cycle from the Glossary) Design - http://www.merriam-webster.com/ Create - http://www.merriam-webster.com/ Adapts - http://www.merriam-webster.com/ Model - http://www.merriam-webster.com/ Tool - http://www.merriam-webster.com/ Innovation - adapted from Dictionary.com Cooperative learning strategies - (needs definition) Collaboration - http://www.merriam-webster.com/ Team - http://www.merriam-webster.com/ SME - Subject Matter Expert - MSDE Plan - http://www.merriam-webster.com/ SME - Subject Matter Expert - MSDE Listening - http://www.merriam-webster.com/dictionary/listen
- Netiquette - Adapted from http://www.bpl.org/kids/netiquette.htm
- Piracy - Adapted from http://www.techterms.com/definition/piracy
- Project-based learning - Adapted from http://pbl-online.org/About/whatisPBL.htm
- Science -Adapted from http://dictionary.reference.com/browse/science
- Scientific method - Adapted from http://www.me.unlv.edu/Undergraduate/coursenotes/meg497/ABETdefinition.htm
- Solution -Adapted from http://dictionary.reference.com/browse/solution?s=t